

# Frequency and Risk Factors of Postoperative Hyponatremia in Primary Hip and Knee Arthroplasties Patients at a Tertiary Care Hospital, Karachi, Pakistan

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## Article Info

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## Abstract

**Objective:** To determine the frequency of hyponatremia and risk factors (age, comorbidities) and its impact on length of hospital stay in patients who underwent primary hip and knee replacement at a tertiary care hospital, Karachi, Pakistan.

**Methodology:** The present study was conducted at Department of orthopedics, Agha Khan hospital with cross sectional study design, from December 10, 2019 till June 10, 2020. Sample size was 189 and these were those patients undergoing hip and knee arthroplasty. Quantitative data were presented using mean and standard deviation, while qualitative variables were described using frequencies and percentages. SPSS version 21 was utilized for data analysis.

**Results:** The total number of study cases was 189 with mean age of 52.28±6.14 years. Out of 189 patients who underwent hip and knee arthroplasty, 84 (44.4%) had hyponatremia. Participants were divided in two Group A- who had the hyponatremia (n=84) and Group B- who had no hyponatremia (n=105). The mean± S.D of the age in both groups were 54.4±3.8 and 35.97±3.63 years (p=0.000). Participants with hyponatremia were predominantly females (73%, p=0.000). In both group participants with ASA grading 2 were abundant (67%vs56%: p=0.000). Mean± S.D of the length of stay in both groups were 6.6±1.4 and 2.85±0.94 days (p=0.000).

**Conclusion:** Our study revealed a significant 44% incidence of postoperative hyponatremia (POH) among hip and knee arthroplasty patients. Notably, advancing age correlated strongly with POH. Additionally, prolonged surgery duration was identified as a significant risk factor.

**Keywords:** Hyponatremia, hip and knee arthroplasty, Sodium level, risk factors, Postoperative Complications

## Introduction

The most prevalent electrolyte disorder among admitted individuals is hyponatremia.<sup>1,2</sup> Surgical operations, such as Total hip and knee arthroplasties, result in fluid shifts and chemical changes, which can last for weeks after the operation.<sup>3</sup> Neither the prevalence of this surgical anomaly generally nor in this particular orthopaedic group is well-documented in the literature.<sup>4</sup> A small percentage (5-7%) of admitted individuals experience severe hyponatremia.<sup>1,5</sup> If milder drops in sodium levels can be detected and treated faster, perhaps these instances of serious hyponatremia can be prevented.<sup>6</sup> In spite of this, regular test work to identify this electrolyte deficit is often not performed, and even when the shortfall is found, it is often ignored. The subtlety of hyponatremia means that even mild symptoms can rapidly escalate into life-threatening complications.<sup>7</sup> An array of symptoms, including headache, fatigue, nausea, weakening, restlessness, loss of appetite, impaired speech, and disorientation, may indicate hyponatremia.<sup>8</sup> Mild hyponatremia is linked to concentration deficits, walking difficulties, and accidents, all of which are problematic during the therapy of musculoskeletal patients.<sup>9</sup>

Following joint replacement surgery of the lower extremities, surgical sickness and vomiting occur in 20% to 83% of patients.<sup>10,11</sup> The underlying reason of these signs and symptoms may be hyponatremia, and failing to diagnose the chemical imbalance may lead to unnecessary worsening of the condition.<sup>12</sup> Extreme hyponatremia is dangerous and has a terrible outcome, so it should be prevented at all costs.<sup>13</sup> Seizures, brain injury, paralysis, and even mortality may result from the symptoms, which can trigger responses similar to a stroke.<sup>14</sup> In order to better understand the risk factors for perioperative hyponatremia, a research was performed on a cohort of patients who underwent planned hip and knee arthroplasties. Increased awareness of risk factors may enhance the ability to identify individuals susceptible to developing surgical sodium depletion and promptly initiate appropriate therapy. Early recognition of hyponatremia, a frequently encountered and potentially severe post-surgery condition, can significantly decrease the likelihood of complications due to its prompt treatment. The present study was conducted with the aim to determine the frequency of hyponatremia and to determine the risk factors and its impact on length of hospital stay in patients who underwent primary hip and knee replacement at Agha Khan hospital Karachi.

## Methodology

This cross-sectional study was conducted at Department of Orthopedics, Agha Khan Hospital, Karachi, from December 10, 2019 to June 10, 2020. Through non-probability consecutive sampling, patients be-

tween the ages 30-60, of either gender, undergoing hip and knee arthroplasty were included in pre-existing electrolyte imbalance, CNS disease, malnutrition, renal impairment, chronic obstructive pulmonary disease, congestive heart failure, and chronic liver disease were excluded from the present study. All patients provided informed consent for their participation in the study and for the use of their data in research. Upon admission, a concise demographic history was collected from each patient. A blood sample was drawn before operation and post-operatively at days 0, 1, and 2 by the researcher by using a 5cc syringe and drawing 5 ml of blood from the peripheral vein, and preserved for the measurement of serum sodium level. After proper labeling, all samples were transported to the hospital's laboratory for further required investigations. Reporting was done by a qualified Biochemist and was labeled as having hyponatremia (cut-off value <130 mmol/L). The quantitative variables (age, height, weight, length of hospital stay, and duration of surgery) and qualitative variables (gender, smoking status, T2DM, hypertension, dyslipidemia, and duration of surgery) were recorded in the form.

The data was analyzed using SPSS Version 21. Descriptive statistics were used to present demographic data, with means and standard deviations calculated for age, height, weight, length of hospital stay, and duration of surgery. Frequencies and percentages were determined for categorical variables. Ethical approval was obtained from the ethical review committee of Agha Khan University Hospital, Karachi.

## Results

A total of 189 cases who underwent hip and knee arthroplasty visited Department of Orthopedic, Agha Khan Hospital, Karachi and met the inclusion and exclusion criteria were included in this study. Mean age in the study was 52.28±6.14 years. Mean duration of surgery, length of hospital stay, height and weight in the present study was 4.77±1.24 hours, 7.36 ± 2.14 days, 158±7.28 cm and 78.7±9.87 kg respectively. Demographic and clinical parameters of the participants are shown table 1. Out of 189 patients who underwent hip and knee arthroplasty, 84 (44.4%) had and 105 (55.6%) did not have hyponatremia (Figure 1). Participants were divided in two Group A- who had the hyponatremia (n=84) and Group B- who had no hyponatremia (n=105).

The mean age of individuals experiencing postoperative hyponatremia stood at 54.4 years, significantly higher than those who did not develop hyponatremia, with a mean age of 35.97 years ( $p = 0.000$ ) (Table 2). Gender distribution revealed a substantial difference, with 73% of hyponatremia cases being female, compared to 42% in the non-hyponatremia group ( $p = 0.000$ ). While other physical metrics such as height and BMI showed no significant differences between

the groups, notable distinctions emerged in surgical and procedural variables. The American Society of Anesthesiologists (ASA) grading demonstrated significant differences between the two groups, with a higher proportion of patients in the hyponatremia cohort classified under ASA grades 2 and 3 compared to the non-hyponatremia group ( $p = 0.000$ ). Similarly, the type of arthroplasty performed exhibited significant variations, with a larger proportion of knee arthroplasties

in the hyponatremia group compared to the non-hyponatremia group ( $p = 0.000$ ). Length of hospital stay was notably prolonged in patients who developed hyponatremia postoperatively, with a mean stay of 6.6 days compared to 2.85 days in the non-hyponatremia group ( $p = 0.000$ ). Furthermore, differences in drug usage were observed between the two cohorts. The use of thiazide diuretics, ACE inhibitors, and hypotonic solutions was more prevalent among patients who devel-

**Table 1. Baseline characteristics of study cases**

VARIABLE	MEAN ± SD
Age (years)	52.28 ±6.14
Duration of surgery (hours)	4.77 ±1.24
Length of hospital stay (days)	7.36 ±2.14
Height (cm)	158 ±7.28
Weight (kg)	78.7 ±9.87
Gender	
Male	83 (44%)
Female	106 (66%)

**Table 2. Demographic and clinical parameters of the participants with and without hyponatremia.**

Parameters	Hyponatraemia Post-operation (n=84)	No Hyponatraemia-Post-operation (n=105)	P value
Age (years)	54.4±3.8	35.97±3.63	0.000
Female Sex	62 (73%)	44 (42%)	0.000
Height (cm)	152.72±13.01	153.64±13.1	0.456
BMI (Kg/m <sup>2</sup> )	27.64±2.86	27.63±2.9	0.654
ASA Grading			0.000
1	11 (13%)	17 (16%)	
2	56 (67%)	59 (56%)	
3	17 (20%)	29 (28%)	
Type of arthroplasties			0.000
Hip	26 (30%)	37 (35%)	
Knee	49 (58%)	42 (40%)	
Uni-Knee	8 (9%)	26 (25%)	
Length of stay (days)	6.6±1.4	2.85±0.94	0.000
Blood Loss (mL)	150.33±5.9	150.29±6.4	0.545
Operation duration (minutes)	225±8.64	119±7.57	0.113
Use of drugs			
Thiazide diuretics	32 (38%)	40 (38%)	0.05
ACE inhibitors	43 (51%)	56 (53%)	0.002
Hypotonic solutions	36 (43%)	55 (52%)	0.001

oped hyponatremia postoperatively, with statistically significant differences noted ( $p = 0.05$ ,  $p = 0.002$ , and  $p = 0.001$  respectively). These findings underscore the multifactorial nature of postoperative hyponatremia, implicating age, gender, surgical characteristics, length of hospital stay, and medication use as potential risk factors warranting further investigation and clinical

consideration in the management of patients undergoing hip and knee arthroplasties.

## Discussion

Hyponatremia is a prevalent issue encountered across medical and surgical settings, representing the most common electrolyte imbalance. While medical causes contribute significantly, surgery is recognized as a primary risk factor for its development. Postoperative hyponatremia (POH) is known to occur following various surgical procedures, with particular prevalence noted after organ transplantation, cardiovascular, gastroenterology, and trauma surgeries. Orthopedic patients, in particular, face heightened susceptibility to POH due to factors such as fragility, fractures, comorbidities, complex pharmacological treatments, perioperative fluid restrictions, and the nature of surgical interventions. Consequently, previous literature has reported POH incidences ranging from 4% to 40% following orthopedic surgeries,<sup>15,16</sup> although predominantly from retrospective studies encompassing diverse orthopedic procedures. In our current investigation, we observed a POH incidence of 44%, aligning with some recent findings but much higher than the rates reported in a few studies (30%,<sup>17</sup> 27%,<sup>18</sup> and 22%,<sup>19</sup> respectively). Age, female gender, low body weight, and diabetes mellitus have become common risk variables in patient profiles.<sup>16,20</sup> The idea of “frailty” and an increased risk of idiopathic syndrome of inappropriate antidiuretic hormone secretion (SIADH) are associated with an increased risk of hyponatremia as people age.<sup>21</sup> Elderly people are more susceptible to POH, as seen by the clinical illness known as frailty, which is characterized by increasing sarcopenia or a decrease in skeletal muscle mass. In a similar vein, we found that getting older (the mean age of individuals experiencing postoperative hyponatremia was 54.4 years) and having POH were related in our current study. In our study, only the duration of surgery emerged as a significant risk factor for postoperative hyponatremia (POH), while the type of surgery did not show a significant association. The influence of both surgical and anesthetic factors, along with intraoperative patient conditions, likely contribute to this outcome. Variations in surgical techniques among surgeons and differences in intraoperative fluid management practices between institutions may limit the generalizability of this finding. Nonetheless, the extended duration of surgical procedures, particularly evident in orthopedic surgeries, presents a heightened challenge in maintaining fluid balance, potentially explaining the elevated risk of POH. Patients who experienced POH also tended to have prolonged hospital stays, consequently increasing incurred costs. Similar observations of extended hospitalizations have been reported in previous studies.<sup>19,22</sup> However, attributing the sole cause of prolonged hospital stays to POH remains questionable, as research indicates multifaceted reasons for such outcomes.

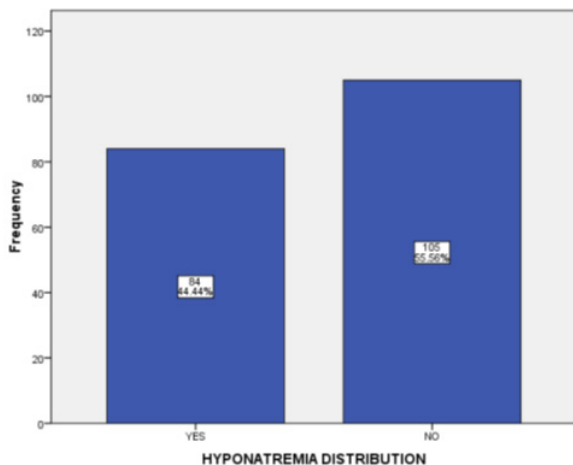


Figure 1: Frequency of the patients showing hyponatremia distribution

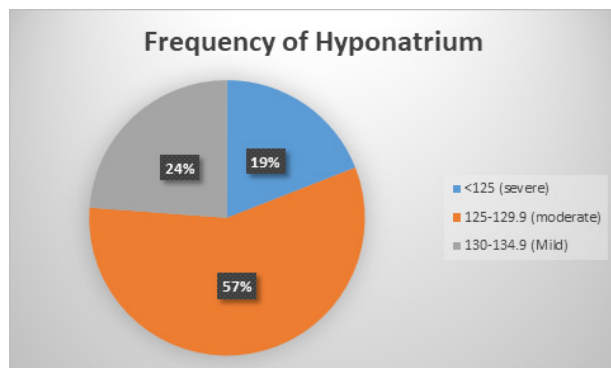


Figure 2: Frequency of the patients with mild, moderate and severe hyponatremia

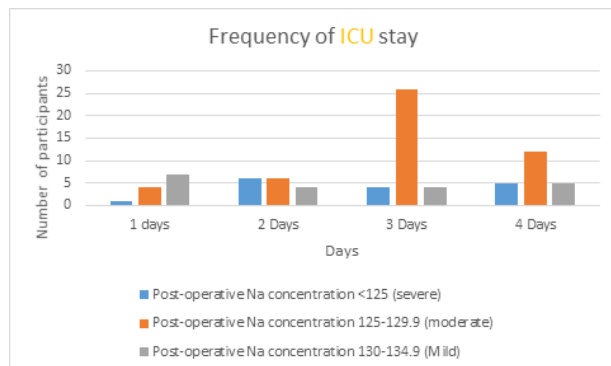


Figure 3: Frequency of the participants with mild, moderate and severe hyponatremia with length of stay in hospital

## Conclusion:

In conclusion, our study at Agha Khan Hospital in Karachi revealed a significant 44% incidence of postoperative hyponatremia (POH) among hip and knee arthroplasty patients. Notably, advancing age correlated strongly with POH. Additionally, an extended duration of surgery was found to be a significant risk factor. While POH was associated with extended hospital stays, attributing this solely to POH remains uncertain. Our findings underscore the need for tailored perioperative management to mitigate POH risk and improve outcomes for patients undergoing joint arthroplasties.

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